Radiographic maxillary sinus findings in the elderly

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The prevalence of radiographic maxillary sinus findings in 293 elderly subjects (76, 81, and 86 years old) were investigated with the use of panoramic radiography: 124 subjects were edentulous in both jaws, 167 had an edentulous maxilla, and 169 had at least one natural tooth left. Mucous cysts or diffuse mucosal thickenings were found in 12% of the subjects. Of the mucosal thickenings, 70% were found in subjects with a dentate upper jaw ($p < 0.05$), suggesting an odontogenic origin for that proportion (40%) exceeding the prevalence in subjects edentulous in the maxilla. That the prevalence of mucous cysts was 5% both in subjects with a dentate upper jaw and in those with a edentulous upper jaw suggests nonodontogenic causes. **(ORAL SURG ORAL MED ORAL PATHOL ORAL RADIOL ENDOD 1995;80:487-91)**

The maxillary sinus mucosa responds to irritating stimuli by swelling from its normal 1 mm thickness to 10 to 15 mm.[1] If a duct of a seromucinous gland is blocked during an inflammatory period, the secretion dilates the gland and duct forming a cyst lined with epithelium; this is the secretory type of mucous cyst, also called a retention cyst.[1-6] If, for example, an odontogenic infection causes irritation in the sinus wall without directly extending into the sinus, it may cause capillary damage and fluid leakage. The inflammatory exudate, not a simple serum transudate or mucus,[1, 2] pools above the periosteum[1, 2, 5, 7] forming a pseudocyst, the nonsecretory type of mucous cyst.[1-3, 5, 7]

A polyp is formed when fluid accumulates in the loose connective tissue, a phenomenon often seen in the sinonasal tract in allergic conditions.[6] A mucocele is a large bone-destroying cyst that is actually the sinus enlarging behind a blocked ostium[8]; this is most common in the ethmoidal and frontal sinuses. Mucoceles are uncommon in the maxillary sinus, but when present, they can cause gross facial asymmetry and severe clinical symptoms.[1, 6, 8, 9, 10] The surgical ciliated cysts of the maxilla or "postoperative mucoceles" do not necessarily involve the whole maxillary sinus.[8]

The radiographic appearance of retention cysts and of pseudocysts is similar, a well-defined "dome-shaped" uniform radiopacity with a rounded outline rising from the floor or walls of the sinus.[1, 5] Retention cysts, however, seldom become large enough to be visible radiographically.[4, 6] Odontogenic cysts, which may also encroach on the maxillary sinus, have a thin radiopaque bony margin that is absent in mucous cysts.[1, 5]

There are also other more diffuse mucosal changes with a different radiographic appearance from that of mucous cysts. These "mucosal thickenings" appear as a diffuse, often polypous, radiopacity along the margins of the sinus without a well-defined rounded outline. Polyps are often multiple, pendulous, and more irregularly shaped than mucous cysts.[11-13]

In radiographic studies of mucous cysts found in the maxillary sinuses of both dentate and edentulous subjects, prevalence figures ranging from 2% to 13% have been reported.[1, 5, 12, 14-22] The diffuse mucosal thickenings are more common, with frequencies up to 50% of radiographic incidental findings (mucous cysts included) in the paranasal sinuses,[23] and these are most common in the maxillary sinuses.[24]

Periodontitis or periapical infection may also cause mucosal swelling or sinusitis,[25] and odontogenic sinusitis represents between 5% and 45% of all sinusitises.[22] Odontogenic infections such as these may present few symptoms locally but still manifest potentially dangerous systemic symptoms, such as fever of unknown origin.[26, 27]

Mucous cysts and the other mucosal thickenings usually cause no symptoms, but occasionally they have been related to a variety of symptoms, mainly facial pain, headache, and toothache.[1, 2, 4, 28, 29] Mucous cysts tend to rupture and clear up spontaneously,[1, 30] and mucosal thickenings resolve when their cause is removed.[25] In symptomatic cases, however, surgical removal of the cyst may be indicated.[28]

The maxillary sinus is clearly imaged in panoramic radiography, but small changes outside the 2 to 3-cm thick sharply depicted layer are not visualized; in the

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Table I. Subjects of the study

	Age in years			
	76	81	86	Total
Men	44 (15%)	28 (10%)	14 (5%)	86 (29%)
Women	106 (36%)	59 (20%)	42 (14%)	207 (71%)
Total	150 (51%)	87 (30%)	56 (19%)	293 (100%)

Table II. Maxillary sinus findings (N) according to age

	Age in years							
	76		81		86		Total	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Normal	127	86	77	89	48	87	252	87
Mucous cyst	7	5	1	1	6	11	14	5
Diffuse mucosal thickening	14	9	8	9	1	2	23	8
Total	148	100	86	100	55	100	289	100

In four cases sinuses were not diagnostically depicted.

Table III. Maxillary sinus findings according to sex

	Women		Men		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
Normal	183	89	69	83	252	87
Mucous cyst	9	4	5	6	14	5
Diffuse mucosal thickening	14	7	9	11	23	8
Total	206	100	83	100	289	100

In four cases sinuses were not diagnostically depicted.

normal panoramic projection, the roof of the maxillary sinus is not imaged.[22] However, mucous cysts and other mucosal thickenings are usually well demonstrated, as they almost always arise from the antral floor.[1, 4, 13, 17, 31, 32]

Few studies have thus far been made to assess the prevalence of maxillary sinus findings in the elderly.

The aim of the present study was to investigate, with the use of panoramic radiography, the prevalence of maxillary sinus findings in elderly subjects aged 76, 81, and 86 years, and to test the hypothesis that such findings are more prevalent in dentate subjects.

MATERIAL AND METHODS

This investigation is a part of a large Finnish medical and dental survey of a random sample of elderly subjects (total, 8035) who were born in 1904, 1909, and 1914 and living in Helsinki in January 1989.[33] The response rate for the medical survey from the random sample of 795 elderly invited to participate was 81.8% (n = 651).[33] Between 1989 and 1990, 651 subjects participated in the medical examination. Before May 31, 1990 the mortality among the participants in the medical survey was 8.0% (n = 51). In 1990 and 1991, the 600 subjects who were still alive were invited to the Institute of Dentistry for a comprehensive dental examination. A total of 133 of the 600 were interviewed only by phone or by mail, and no dental data were available for 103 subjects. Altogether 364 subjects remained, 28% were men and 72% women; they were examined in 1990 and 1991.[34] The response rate for invited men was 69% and for women 58%. Of the 364 subjects, 293 attended the Institute of Dentistry and were examined clinically and radiographically, whereas 71 subjects were examined clinically only in their homes or in institutions. The subjects were radiographed between the months of August 1990 and June 1991.

Of the 293 subjects radiographed (86 men and 207 women) (Table I), 169 (54 men and 115 women) had one or more clinically visible natural teeth left. They

Table IV. Maxillary sinus findings in clinically edentulous or dentulous subjects

	Edentulous		*Dentulous*		*Total*	
	Number	*Percentage*	*Number*	*Percentage*	*Number*	*Percentage*
Normal	116	93	136	82	252	87
Mucous cyst	4	3	10	6	14	5
Diffuse mucosal thickening	4	3	19	12	23	8
Total	124	100	165	100	289	100

Table V. Maxillary sinus findings in subjects with edentulous or dentulous maxilla

	Edentulous maxilla		*Dentulous maxilla*		*Total*	
	Number	*Percentage*	*Number*	*Percentage*	*Number*	*Percentage*
Normal	150	91	102	82	252	87
Mucous cyst	8	5	6	5	14	5
Diffuse mucosal thickening	7	4	16	13	23	8
Total	165	100	124	100	289	100

Total chi-square: 7.28, $p = 0.0262$.

formed the dentulous subgroup. The mean number of teeth in this group was 17.0 for men and 14.5 for women,[35] with 124 subjects (32 men and 92 women) clinically edentulous.[36] Patients with at least one radiographically visible natural tooth or root in the upper jaw numbered 126 (44 men, 82 women), whereas 167 (42 men, 125 women) were radiographically edentulous in the upper jaw with not even any impacted teeth or retained roots in the maxilla.

Panoramic radiographs were taken with a PM 2002 radiographic apparatus (Planmeca Oy, Helsinki, Finland). Trimax T16 intensifying screens and GTU x-ray film (3M Co., St. Paul, Minn.) were used. Intraoral radiographs of areas poorly visible in the panoramic radiograph were taken using a Siemens Heliodent 70 dental radiographic unit (Siemens Medical Engineering, Dental Sector, Bensheim, Germany) and Kodak Ultra-speed x-ray film (Eastman Kodak Co., Rochester, Minn.). In all, 169 panoramic and 109 intraoral radiographs were taken. All films were developed by automatic processing. Intraoral films were mounted in frames. The radiographs were studied by one dental radiologist (K.S.) under standardized conditions with the use of Mattson's binoculars (X-Produkter, Malmö, Sweden) with a ×2 magnification and a viewing light of adjustable brightness when necessary.

Findings of increased radiopacity in the maxillary sinuses were recorded and divided into two categories: mucous cysts, well-defined radiopacities with a rounded (convex) outline rising from the floor or walls of the sinus; and mucosal thickenings, which represented the more diffuse radiopacities along the margins of the sinus without well-defined rounded outlines.

Table VI. Intra-examiner variation in re-examination of 41 patient radiographs

		Round 2		
		Normal	*Finding*	*Total*
Round 1	Normal	35	1	36
	Finding	0	5	5
	Total	35	6	41

K: 0.58, fair agreement.

The intra-examiner variation was assessed by re-examining the radiographs of 41 randomly selected patients (21 dentulous, 20 edentulous). The interval between the two rounds of viewings was 6 months.

The manually calculated Cohen's kappa test was used to determine the statistical significance of the intra-examiner agreement. The other data were analyzed with the chi square test, and the StatView SE+ Graphics (Abacus Concepts Inc., Berkeley, Calif.) statistical program package for the Macintosh computer (Apple Computer Inc., Cuppertino, Calif.).

RESULTS

In the material as a whole, mucous cysts or mucosal thickenings were found in 37 subjects (12%). In 14 subjects (5%) the findings were classified as mucous cysts. Diffuse mucosal thickenings were found in 23

cases (8%). The sex and age distributions of the radiographic maxillary sinus findings are summarized in Tables II and III. Seventy-one percent of the mucous cysts and 83% of the diffuse mucosal thickenings were found in clinically dentate subjects (Table IV).

Twenty-two of the subjects with at least one radiographically visible natural tooth or root in the upper jaw had radiopaque findings in their maxillary sinuses (18%). In six of these subjects (5%), the findings were classified as mucous cysts. Diffuse mucosal thickenings were found in 16 cases (13%) (Table V). Seventy percent of the diffuse mucosal thickenings were found in subjects with at least one radiographically visible natural tooth or root in the upper jaw ($p < 0.05$). The prevalence of mucous cysts was 5% in both subjects with at least one radiographically visible natural tooth or root in the upper jaw and those with completely edentulous upper jaw.

No statistically significant differences were found between the sexes or between age groups, although the prevalence of diffuse mucosal thickenings diminished slightly with age. No destructive mucoceles were found. In four cases the sinuses were not diagnostically depicted.

The intra-examiner agreement between the two rounds of viewings was fair, (K = 0.58) (Table VI).

DISCUSSION

The prevalence of mucous cysts and diffuse mucosal thickenings in the maxillary sinuses of our elderly edentulous subjects was 7%. However, figures ranging from 2.6% to 20% have been reported from other studies of edentulous subjects.[37, 38]

Studies of rounded shadows (mucous cysts) in maxillary sinuses found, in both dentate and edentulous subjects, figures ranging from 2% to 13%.[1, 5, 12, 14-22] Our figure of 5% for the prevalence of mucous cysts falls within that range. The prevalence of mucous cysts and diffuse mucosal thickenings in all the paranasal sinuses together has occasionally been as high as 50% in facial radiographs taken for indications other than suspected sinus disease.[23] In a magnetic resonance imaging study of incidental findings in the paranasal sinuses of 438 subjects, the prevalence of incidental findings in all sinuses was 37.5%; and they were most common in the maxillary sinuses (27%).[24] According to Mattila[17] the prevalence of mucous cysts is not age-dependent. In studies including younger age groups, mucous cysts have been most prevalent in the third decade, and they have also been found to be more prevalent in men.[1, 5, 22] In the rather narrow age-range of the present study's very old subjects, the number of mucous cysts showed no age-dependent tendencies. The diffuse mucosal thickenings, however, were slightly more prevalent in the younger age groups, who had more teeth. The majority of both the mucous cysts and the diffuse mucosal thickenings were found in dentate subjects. However, the same percentage of mucous cysts (5%) was observed in subjects with natural teeth in the upper jaw and in those with an edentulous upper jaw.

From the similar prevalences of mucous cysts in the two groups it can be suspected that odontogenic causes may not be a major contributing factor in their formation. The prevalence and size of mucous cysts in sites of periapical or periodontal pathosis and in sites without pathologic findings have also previously been found to be similar.[21] Neither that finding nor ours supports the findings of Halstead,[30] who reported that a possible odontogenic cause could be indicated in 90% of subjects with mucous cysts. However, in the present study, 70% of the diffuse mucosal thickenings were found in subjects who had at least one radiographically visible natural tooth or root in the upper jaw. Thus it may be suspected that the diffuse thickenings may be odontogenic in origin for that proportion (40%) of subjects exceeding the prevalence of the same findings in the sinuses of subjects with no maxillary teeth at all.

The presence of mucosal thickenings in the maxillary sinus floor always indicates the presence of irritative stimuli, often an infection of dental origin. Such infective foci (chronic apical periodontitis, deep infrabony pockets caused by periodontitis) are usually unaccompanied by any major subjective symptoms. Their accurate diagnosis may sometimes be vital to the patient, for if the host resistance decreases for some reason, it will give these infections an opportunity to become exacerbated and cause acute sinusitis, whereas the possibility also exists of further spread and systemic manifestations.[26, 27]

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